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SOCIO-ECONOMIC ANALYSIS:
PROPOSED AMENDMENTS TO REGULATION 8, RULE 18 ("EQUIPMENT LEAKS"), REGULATION 11, RULE 10 ("HEXALENT CHROMIUM EMISSIONS AND TOTAL HYDROCARBON EMISSIONS FROM PETROLEUM REFINERY COOLING TOWERS"), and DRAFT NEW REGULATION 6, RULE 5 ("PARTICULATE EMISSIONS FROM REFINERY FLUIDIZED CATALYTIC CRACKING UNITS")

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APPLIED DEVELOPMENT ECONOMICS

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BAY AREA GREEN BUSINESS

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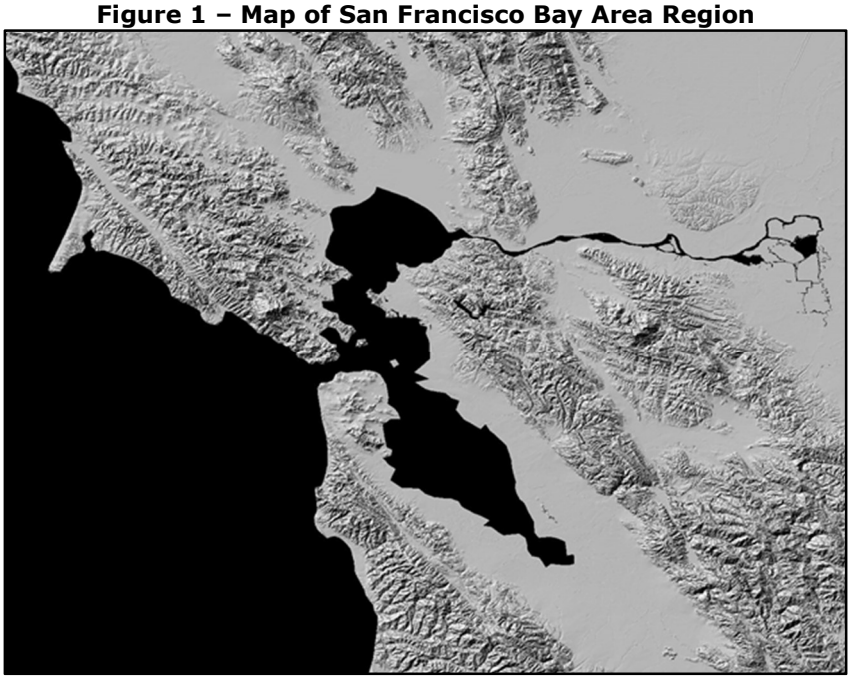
INTRODUCTION

The Bay Area Air Quality Management District ("BAAQMD" or the "Air District") seeks to amend two existing rules to reduce emissions from oil refineries operating in the Bay Area. In addition, the Air District seeks to adopt a new rule with the same effect in mind. The proposed new rule is Draft Regulation 6 Rule 5 ("Particulate Emissions from Refinery Fluidized Catalytic Cracking Units [FCCUs]"). BAAQMD seeks to amend and rename existing Regulation 11 Rule 10 ("Hexavalent Chromium and Total Hydrocarbon Emissions from Petroleum Refinery Cooling Towers"), the purpose of which is to achieve technically feasible and cost-effective total hydrocarbon (THC) and hazardous air pollutants emission reductions from cooling towers at Bay Area refineries by requiring more rapid detection of heat exchanger leaks. BAAQMD also proposes to amend Regulation 8 Rule 18 ("Equipment Leaks"). After this introduction, this report discusses in greater detail the various rule changes the Air District proposes with regard to Draft Rule 6-5, Rule 8-18, and Rule 11-10 (Section Two). After that discussion, the report describes the socioeconomic impact analysis methodology and data sources (Section Three). The report describes population and economic trends in the nine-county San Francisco Bay Area (Section Four), which serves as a backdrop against which the Air District is contemplating the three sets of rule changes. Finally, the socioeconomic impacts stemming from the proposed rule changes are discussed in Section Five.

The report is prepared pursuant to Section 40728.5 of the California Health and Safety Code, which requires an assessment of socioeconomic impacts of proposed air quality rules. The findings in this report can assist Air District staff in understanding the socioeconomic impacts of the proposed requirements, and can assist staff in preparing a refined version of the rule. Figure 1 is a map of the nine-county region that comprises the San Francisco Bay Area Air Basin.

Figure 1 – Map of San Francisco Bay Area Region



BACKGROUND TO PROPOSED AMENDMENTS TO EXISTING RULE 11-10 AND RULE 8-18, AND PROPOSED NEW RULE 6-5

This part of the report summarizes key changes to existing rules Rule 8-18 and Rule 11-10. In addition, proposed new Rule 6-5 is summarized below.

SUMMARY OF PROPOSED AMENDMENTS TO REGULATION 8, RULE 18

Oil refineries, chemical plants, bulk plants, bulk terminals, and other facilities that store, transport, and use volatile organic liquids lose some organic material as fugitive emissions wherever there is a connection between two pieces of equipment. Valves, pumps, and compressors also leak organic material. Rule 8-18 requires such facilities to maintain a leak detection and repair (LDAR) program. The purpose of the LDAR program is to ensure that all equipment is inspected regularly and, if a leak is found to exceed the leak threshold, the equipment must be repaired, replaced, or placed on a list of non-repairable equipment. Currently, equipment in heavy liquid service is only subject to the applicable leak standards in Section 8-18-300, and not to the LDAR requirements in Section 8-18-400. Without routine inspections of equipment in heavy liquid service, leaks may not be found and repaired. In an effort to strengthen existing rules, the Air District is considering the following changes to Regulation 8, Rule 18, which would:

- Become effective January 1, 2018:
    - Include identification and monitoring of heavy liquid service equipment, and
    - Subject heavy liquid service equipment to leak minimization and repair requirements;
- Amend the non-repairable equipment standard to reduce the allowable amount of equipment placed on non-repairable list;
- Identify the cause of any background reading greater than 50 ppmv;
- Require mass emission monitoring for all equipment placed on the non-repairable equipment list; and
- Add a maximum leak concentration and/or mass emissions limit for fugitive equipment subject to the rule.

In addition, administrative changes to rule language will be made to improve clarification and enforceability of the rule.

SUMMARY OF PROPOSED AMENDMENTS TO REGULATION 11, RULE 10

The Bay Area has five large-scale petroleum refineries which operate a total of 32 cooling towers. These cooling towers are large, industrial heat exchangers that are used to dissipate significant heat loads to the atmosphere from process equipment that contains organic compounds, through the evaporation of cooling water. When a heat exchanger leaks, organic compounds can pass from the process equipment into the cooling water. If a leak is not detected and repaired, significant quantities of organic compounds can be released into the atmosphere when the cooling water is exposed to the atmosphere in the cooling tower.

District Regulation 11, Rule 10 was developed in 1989 to reduce hexavalent chromium emissions from cooling towers. The goal of the proposed amendments to Regulation 11, Rule 10 is to achieve technically feasible and cost-effective total hydrocarbon (THC) and hazardous air pollutants emission reductions from cooling towers at Bay Area refineries by requiring more rapid detection of heat exchanger leaks. A concept paper issued by the Air District underscored the importance of rapid detection: "Emissions resulting from leaks can become significant if heat exchanger leaks go undetected for long periods of time. In 2010 a heat exchanger leak at a Bay Area refinery resulted in emissions of at least 52 tons of VOC over a recorded period of a few weeks. The total magnitude of emissions from the leak event was greater; emissions from the event were only estimated once the leak was detected, which was likely weeks if not months after the leak began."[1]

SUMMARY OF DRAFT NEW REGULATION 6, RULE 5

Fluidized catalytic cracking units (FCCUs) are complex processing units at refineries that convert heavy components of crude oil into lighter compounds used in the production of gasoline and other transportation fuels. The FCCU uses a fine catalyst powder to promote the cracking reaction. During this reaction, the catalyst becomes coated with petroleum coke, which is burned off in the regenerator portion of the FCCU so that the catalyst can be reused. The regenerator vessel exhaust contains particulate matter (PM), sulfur dioxide (SO_2), ammonia, carbon monoxide (CO), oxides of nitrogen (NOx), and volatile organic compounds (VOC).

The goal of this rulemaking is to achieve technically feasible and cost-effective emission reductions of PM less than 2.5 microns in diameter ($PM_{2.5}$) and $PM_{2.5}$ precursors (compounds that form $PM_{2.5}$ by chemical reactions in the atmosphere after being emitted from a given source) from FCCUs at Bay Area refineries. The Air District plans to achieve emission reductions with two actions, as described in the "Workshop Report for the Refinery Emissions Reduction Strategy." The first action, addressed in this report, will propose a new regulation that will address ammonia emissions (a $PM_{2.5}$ precursor) at those FCCUs that use ammonia or urea injection. The second, future action will amend Regulation 6,

[1] BAAQMD, "Appendix C: Concept Paper for Changes to Rule 11-10: Colling Towers", page C:2 (2015)

Rule 5, to further address emissions of $PM_{2.5}$ and $PM_{2.5}$ precursors. The specific elements of this second action will depend in part on the results of the first action.

Of the five petroleum refineries operating in the Bay Area, four — Chevron, Shell, Tesoro, and Valero — operate FCCUs. The Valero refinery recently retrofitted its FCCU with a wet scrubber which has significantly reduced the emissions from this FCCU. Valero will be exempt from the proposed ammonia emission limit. The Chevron and Tesoro FCCUs use ammonia to promote the control of filterable particulate matter emissions in electrostatic precipitators (ESPs), which results in unreacted ammonia being emitted to the atmosphere ("ammonia slip"). The Shell FCCU uses ammonia or urea injection to control NOx generation and also to promote ESP operation, which results in unreacted ammonia being emitted to the atmosphere.

METHODOLOGY

Applied Development Economics (ADE) began this analysis by preparing a statistical description of the industry groups of which the affected sources are a part, analyzing data on the number of establishments, jobs, and payroll. We also estimated sales generated by impacted industries, as well as net profits for each affected industry.

This report relies heavily on the most current data available from a variety of sources, particularly the State of California's Employment Development Department (EDD) Labor Market Information Division. In addition, this report relies on data from the US Census County Business Patterns, as well as from the US Internal Revenue Service.

With the above information, ADE was able to estimate net after tax profit ratios for sources affected by the proposed rule. ADE calculated ratios of profit per dollar of revenue for affected industries. The result of the socioeconomic analysis shows what proportion of profits the compliance costs represent. Based on assumed thresholds of significance, ADE discusses in the report whether the affected sources are likely to reduce jobs as a means of recouping the cost of rule compliance or as a result of reducing business operations. To the extent that such job losses appear likely, the indirect multiplier effects of the jobs losses are estimated using a regional IMPLAN input-output model. In some instances, particularly where consumers are the ultimately end-users of goods and services provided by the affected sources, we also analyzed whether costs could be passed to households in the region.

When analyzing the socioeconomic impacts of proposed new rules and amendments, ADE attempts to work closely within the parameters of accepted methodologies discussed in a 1995 California Air Resources Board (ARB) report called "Development of a Methodology to Assess the Economic Impact Required by SB513/AB969" (by Peter Berck, PhD, UC Berkeley Department of Agricultural and Resources Economics, Contract No. 93-314, August, 1995). The author of this report reviewed a methodology to assess the impact that California Environmental Protection Agency proposed regulations would have on the ability of California businesses to compete. The ARB has incorporated the methodologies described in this report in its own assessment of socioeconomic impacts of rules generated by the ARB. One methodology relates to determining a level above or below which a rule and its associated costs is deemed to have significant impacts. When analyzing the degree to which its rules are significant or insignificant, the ARB employs a threshold of significance that ADE follows. Berck reviewed the threshold in his analysis and wrote, "The Air Resources Board's (ARB) use of a 10 percent change in [Return on Equity] ROE (i.e. a change in ROE from 10 percent to a ROE of 9 percent) as a threshold for a finding of no significant, adverse impact on either competitiveness or jobs seems reasonable or even conservative."

REGIONAL DEMOGRAPHIC AND ECONOMIC TRENDS

This section of the report tracks the larger economic and demographic contexts within which the Air District is contemplating amendments and new rules that will affect five refineries in the Bay Area. This section begins with a broad overview of demographic and economic trends, with discussion then narrowing to industries and sources affected by the proposed rule changes.

REGIONAL DEMOGRAPHIC TRENDS

Table 1 tracks population growth in the nine-county San Francisco Bay Area between 2004 and 2014, including data for the year 2009. Between 2004 and 2009, the region grew by approximately 1 percent a year. Between 2009 and 2014, the region grew annually at a much slower rate of 0.1 percent per year. Overall, there are 7,510,942 people in the region. At 1,889,638, Santa Clara County has the most people, while Napa has the least, at 140,362.

Table 1: Regional Demographic Trends: 2004-2014: Population Growth: San Francisco Bay Area

AREAS	2004	2009	2014	04-09 CAGR	09-14 CAGR	04-14 CAGR
California	36,810,358	38,648,090	38,714,725	1.0%	0.03%	0.5%
SF Bay Area	7,096,575	7,459,858	7,510,942	1.0%	0.1%	0.6%
Alameda County	1,507,500	1,574,857	1,594,569	0.9%	0.2%	0.6%
Contra Costa County	1,020,898	1,073,055	1,102,871	1.0%	0.5%	0.8%
Marin County	252,485	260,651	258,972	0.6%	-0.1%	0.3%
Napa County	133,294	138,917	140,362	0.8%	0.2%	0.5%
San Francisco County	799,263	856,095	845,602	1.4%	-0.2%	0.6%
San Mateo County	723,453	754,285	753,123	0.8%	-0.03%	0.4%
Santa Clara County	1,759,585	1,880,876	1,889,638	1.3%	0.1%	0.7%
Solano County	421,657	427,837	429,552	0.3%	0.1%	0.2%
Sonoma County	478,440	493,285	496,253	0.6%	0.1%	0.4%

Source: Applied Development Economics, based on California Department of Finance Population Estimates E-5 Reports (2005, 2010, and 2015)(Note: CAGR = Compound Annual Growth Rate)

REGIONAL ECONOMIC TRENDS

Data in Table 2 describe the larger economic context within which officials are contemplating amendments to Regulations 11-10, 8-18, and new Rule 6-5. Businesses in the region employ over three million workers, or 3,525,910. The number of private and public sector jobs in the region grew annually by 1.8 percent between 2009 and 2014, after having increased somewhat slightly between 2004 and 2009 by 0.2 percent a year. Of the 3,525,910 workers, 429,768, or 12.2 percent, are in the public sector, meaning 87.8 percent of all employment is in the private sector. Economic sectors in the table below are sorted by the share of total employment. The top-five sectors in the Bay Area are Health and Social Assistance (NAICS 62) (427,982 workers), Professional/Technical Services (NAICS 54) (399,834 workers), Retail (NAICS 44-45) (335,791), Manufacturing (NAICS 31-33) (318,909) and Public Sector except Education. Of the top-ten leading sectors in terms of employment, five exhibited

high rates of annual growth from 2009 to 2015, growing annually by more than four percent. These sectors are Health and Social Assistance, Professional/Technical Services, Eating and Drinking Places, Administrative Support (NAICS 561), and Information (NAICS 51). Combined, these five sectors employ 41 percent of total employment, or 1,444,160 out of 3,525,910. In the state, only Healthcare and Social Assistance and Administrative Support grew annually by faster than four percent, and, relative to the Bay Area, employment in these five sectors at the state level represent a lesser share of total employment, i.e. 37 percent, or 5,865,991 out of 15,809,083. In other words, the leading sectors in the Bay Area perform better than comparable sectors in the state as a whole. Moreover, of the top-ten leading sectors in the Bay Area, only one (Public Sector except Education) had less workers in 2014 than in 2009, underscoring the resilience of the regional economy in the aftermath of the Great Recession. By way of comparison, of the top ten leading sectors in the state, three (Manufacturing, Public Sector excluding Education, and Public Sector Education) still have not recovered from the Great Recession, exhibiting less workers now than in 2009.

Table 2: San Francisco Bay Area Employment Trends By Sector and Select Industries: 2004 - 2014

	Bay Area							California						
Sectors	2004	2009	2014	Distribution. 2014	Rank	04-09 CAGR	09-14 CAGR	2004	2009	2014	Distribution 2014	Rank	04-09 CAGR	09-14 CAGR
Private & Public Sectors	3,191,935	3,225,980	3,525,910	100.0%		0.2%	1.8%	17,218,905	16,970,214	15,809,083	100.0%		-0.3%	-1.4%
Private Sector	2,750,092	2,784,163	3,096,142	87.8%		0.2%	2.1%	14,875,824	14,546,383	13,501,711	85.4%		-0.4%	-1.5%
Public Sector	441,843	441,817	429,768	12.2%		0.0%	-0.6%	2,343,081	2,423,831	2,307,372	14.6%		0.7%	-1.0%
62 Health, Social Assist	281,219	311,429	427,982	12.1%	1	2.1%	6.6%	1,284,158	1,435,436	2,000,372	12.7%	1	2.3%	6.9%
54 Professional, Tech.	277,827	321,808	399,834	11.3%	2	3.0%	4.4%	911,684	1,012,533	1,171,165	7.4%	6	2.1%	3.0%
44-45 Retail	332,742	309,241	335,791	9.5%	3	-1.5%	1.7%	1,613,395	1,513,767	1,623,371	10.3%	2	-1.3%	1.4%
31-33 Manufacturing	353,215	314,263	318,909	9.0%	4	-2.3%	0.3%	1,517,533	1,275,752	1,264,114	8.0%	4	-3.4%	-0.2%
Public Sector exc. Educ	293,586	301,289	285,923	8.1%	5	0.5%	-1.0%	1,279,867	1,331,656	1,280,253	8.1%	3	0.8%	-0.8%
722 Eating, Drinking Pl	209,204	225,123	280,016	7.9%	6	1.5%	4.5%	996,086	1,053,084	1,260,661	8.0%	5	1.1%	3.7%
561 Admin. & Support	170,698	154,174	188,502	5.3%	7	-2.0%	4.1%	899,139	798,632	976,801	6.2%	8	-2.3%	4.1%
23 Construction	182,894	142,030	160,702	4.6%	8	-4.9%	2.5%	845,747	618,068	669,766	4.2%	10	-6.1%	1.6%
51 Information	114,908	111,333	147,826	4.2%	9	-0.6%	5.8%	482,608	438,640	456,992	2.9%	13	-1.9%	0.8%
Public Sector Education	148,257	140,528	143,845	4.1%	10	-1.1%	0.5%	1,063,214	1,092,175	1,027,119	6.5%	7	0.5%	-1.2%
42 Wholesale	121,948	115,992	123,664	3.5%	11	-1.0%	1.3%	650,334	645,959	709,154	4.5%	9	-0.1%	1.9%
81 Other Services	140,657	157,003	120,053	3.4%	12	2.2%	-5.2%	666,102	740,659	504,176	3.2%	12	2.1%	-7.4%
52 Finance & Insurance	147,378	128,158	119,297	3.4%	13	-2.8%	-1.4%	619,396	539,753	515,504	3.3%	11	-2.7%	-0.9%
611 Private Education	63,445	76,295	91,463	2.6%	14	3.8%	3.7%	232,470	279,124	317,066	2.0%	16	3.7%	2.6%
55 Mgt of Companies	63,228	59,185	73,268	2.1%	15	-1.3%	4.4%	233,847	197,752	225,792	1.4%	19	-3.3%	2.7%
48-49 Trnsprt\Warhsng	53,541	49,753	68,367	1.9%	16	-1.5%	6.6%	409,583	399,259	446,430	2.8%	14	-0.5%	2.3%
71 Entertainmnt & Rec	49,505	50,679	59,064	1.7%	17	0.5%	3.1%	236,527	243,203	276,312	1.7%	17	0.6%	2.6%
53 Real Estate, Leasing	60,592	53,776	56,598	1.6%	18	-2.4%	1.0%	276,460	254,863	264,129	1.7%	18	-1.6%	0.7%
721 Accommodations	45,832	45,556	48,669	1.4%	19	-0.1%	1.3%	197,036	197,496	211,139	1.3%	20	0.0%	1.3%
99 Misc	48,243	45,602	43,443	1.2%	20	-1.1%	-1.0%	53,008	64,639	60,738	0.4%	21	4.0%	-1.2%
11 Agriculture	16,005	18,502	14,754	0.4%	21	2.9%	-4.4%	369,951	373,603	415,444	2.6%	15	0.2%	2.1%
562 Waste Managemnt	10,340	10,796	11,606	0.3%	22	0.9%	1.5%	37,679	40,330	46,329	0.3%	23	1.4%	2.8%
22 Utilities	4,710	6,423	4,758	0.1%	23	6.4%	-5.8%	55,960	59,705	57,627	0.4%	22	1.3%	-0.7%
21 Mining	1,961	876	1,576	0.0%	24	-15%	12.5%	21,239	23,865	28,629	0.2%	24	2.4%	3.7%

Source: Applied Development Economics, based on California EDD LMID QCEW 2004, 2009, and 2014 (note: CAGR = Compound Annual Growth Rate)

Of the top ten leading sectors in the Bay Area, four can be categorized as knowledge-based industries that tend to exhibit average higher-pay and have more educated and skilled workforce. These industries (Health and Social Assistance, Professional\Technical Services, Manufacturing, and Information) employ 1,294,551 workers, or 37 percent of total public and private sector workers. Of the top-ten sectors in the state, three are knowledge-based industries (Health and Social Assistance, Manufacturing, and Professional\Technical Services), but their combined workforce represents 28 percent of total employment in the state.

TRENDS FOR INDUSTRIES SUBJECT TO PROPOSED RULE-MAKING

The proposed rule changes affect one particular industry in the Bay Area, namely petroleum refineries. While the California EDD LMID reports that there are 23 refineries in the nine-county region, more than likely, this state agency applied a broader definition for refinery operations in the region. Appendix A identifies a number of "refineries" included in the EDD LMID's database; as this shows, many are not full scale refineries but rather are engaged in a variety of petroleum-related operations. In any event, the proposed new rules will affect five refineries operating in the Bay Area.

Table 3 below identifies the businesses in the Bay Area that are full-scale refineries. The list comes from the CEC, which also included each refinery's throughput capacity. Of the five operating refineries in the region, Chevron is the largest, with the capacity to refine 245,271 42-gallon barrels of crude oil per day. At 78,400, Phillips 66 has the lowest throughput capacity. The five affected sources employ 5,513 workers, who make, on average, $173,700 [2].

Table 3 — Bay Area Refineries (California Energy Commission) and Crude Oil Capacity

Refinery	Barrels Per Day
Chevron U.S.A. Inc., Richmond Refinery	245,271
Tesoro Refining & Marketing Company, Golden Eagle (Avon/Rodeo) Refinery	166,000
Shell Oil Products US, Martinez Refinery	156,400
Valero Benicia Refinery	132,000
Phillips 66, Rodeo Refinery	78,400

Source: Applied Development Economics, Inc., based on California Energy Commission

[2]The 5,513 estimate is based on California EDD LMID and US Census County Business Patterns.

SOCIOECONOMIC IMPACT ANALYSIS

This section of the report analyzes socioeconomic impacts stemming from changes to existing Rule 11-10 and Rule 8-18, as well as impacts stemming from new Draft Rule 6-5. The discussion begins first with a summary of costs associated with each rule. Then, we present our findings with regard to estimated revenues and profits generated by the five affected sources, comparing the combined costs of all three rules against estimated net profits, in an effort to determine if these rules significantly impact the affected industry.

COST OF COMPLIANCE

Below we separately summarize costs associated with the three rule changes.

AMENDMENTS TO EXISTING RULE 11-10

The rule provides three options to perform the new, required hydrocarbon leak monitoring. The first two options are specified (daily manual sampling and analysis; use of a continuous, automated sampler), and the third option is alternative monitoring specified by the refinery and approved by the Air District. Costs are considered only for the two specified options, which may be performed in three ways:

1) Daily, manual sampling and analysis by contract personnel using off-site laboratory facilities. This option entails no capital costs, but has high contractor costs. Twenty-eight cooling towers require daily sampling ($500 for 1st sample at a refinery, $150 for every other cooling tower at the same refinery). Two towers require only weekly sampling because of their low flowrates ($150 for each weekly sample). Two towers require no manual sampling because they are equipped with continuous automated samplers.

2) Daily, manual sampling and analysis by refinery personnel using on-site laboratory facilities. This option entails both capital costs for sampling and analytic equipment and labor costs for staff. Each of the five Bay Area refineries would purchase sampling-analysis systems consisting of an FID analyzer, stripping column and GC analyzer for $25,000. Each refinery would need two complete systems, except for the refinery with the most (13) cooling towers, which would require three complete systems, for a total of 11 complete systems. Each refinery would need two staffers for each system at a cost of $100,000 per year.

3) Continuous, automated sampling. This option entails high capital costs for analyzers and auxiliary equipment such as a shelter. 30 new continuous analyzers would be required (2 cooling towers already have these devices) at an average, installed cost of $300,000 each. The two existing analyzers are assumed to each require $75,000 upgrades). Labor costs associated with maintaining these samplers are assumed to be $25,000 per year for refineries with up to 5 cooling towers, and an additional $25,000 for refineries with more than 5 cooling towers.

With the specified assumptions, the most costly option, which is the basis for the cost impact analysis, is daily manual sampling and analysis by contract personnel with the following annual costs, and no capital costs:

Chevron:	$519,000
Phillips 66:	$402,000
Shell:	$245,000
Tesoro:	$840,000
Valero:	$183,000
Total:	**$2,190,000**

AMENDMENTS TO EXISTING RULE 8-18

District staff has estimated that implementing requirements to Rule 8-18 as amended will result in $6.8 million in total annual costs for the five affected sources. Of the $6.8 million, $250,000 is an annualized amount over 10 years for capital improvements. The balance ($6,550,000) is an annual recurring cost for checking 78,160 valves, 2,930 pumps and 158 pressure relief devices.

DRAFT NEW RULE 6-5

BAAQMD staff believes that, for the Phase 1 part of Rule 6-5 (i.e. the ammonia emission limit), affected refineries, rather than simply reducing ammonia and/or urea injection to reduce ammonia slip emissions to no more than the proposed limit, will instead elect to optimize ammonia and/or urea injection to minimize overall fine particulate emissions, as allowed in the proposed rule. Although optimization will entail sampling and analysis, it will not require permanent sampling equipment or other capital equipment or permanent administrative costs. Monitoring of ammonia emissions will be required, so the costs of compliance are based on the installation and operation of a continuous emission monitoring system (CEMS) at the three non-exempt refineries that operate an FCCU, as described in the staff report.

SOCIOECONOMIC IMPACT ANALYSIS

The five affected sources' combined throughput capacity is approximately 674,582 42-gallon barrels per day, which takes into consideration periods when refineries may be off-line. While the affected sources refine 674,582 barrels of crude oil per day, they generate an estimated 693,044 gallons of refined products a day. Assuming a 87 percent utilization rate, and further estimating the price of refined product at $120 per barrel , we estimate the affected refineries in total generate $30.3 billion in revenues a year, from which is generated $2.1 billion in after-tax net profits. When comparing these figures with the combined annual costs (annual recurring operational costs and annualized capital costs) stemming from Rule 11-10, Rule 8-18, and Draft Rule 6-5 rule changes, we obtain cost-to-net profit ratios of less than one percent (Table 4). For example, with regard to changes to Rule 11-10, in aggregate, affected sources will bear one of three costs. Should all five affected sources pursue Rule 11-10 Option 1 ("daily water sampling"), these sources will be $3.7 million in annual costs. Combining the annual costs of all three rule changes (Rule 11-10 option 1, Rule 8-18, and Draft New Rule 6-5) results in a total cost of $10,523,000, which, when compared against aggregate net profits, amounts to 0.51 percent cost-to-net profit ratio, which is below the 10 percent threshold used for purposes of determining when impacts are significant. As indicated in the table below starting at Row 25, the cost-to-net profit ratios in all cases are below the ten percent threshold. As a result, the combined impacts stemming from Rule 11-10, Rule 8-18, and Draft Rule 6-5 are less than significant. Moreover, because affected sources are not small businesses, small businesses are not disproportionately impacted by the proposed rule changes.

Table 4 — Socioeconomic Impact Analysis: Proposed Amendments to Regulation 11 Rule 10, Regulation 8-18, and New Draft Rule 6-5

Section	Row	Data Attributes	All Refineries	Chevron	Tesoro	Shell	Valero	Phillips 66
Industry Profile	1	Effective Barrels Per Day	674,582	212,648	143,921	135,598	114,443	67,972
	2	Est. Revenues	$30.3 billion	$9.6 billion	$6.5 billion	$6.1 billion	$5.1 billion	$3.1 billion
	3	Est. Net Profits	$2.1 billion	$653 million	$442 million	$416 million	$351 million	$208 million
		Number of Cooling Towers	32	8	13	3	1	7
Cost of Compliance Profile For Each of the Three Rules	4	**Regulation 11 Rule 10 compliance costs**						
	5	Annual Recurring Cost (daily water sampling and analysis by contractors)	$2,190,000	$519,000	$840,000	$245,000	$183,000	$402,000
	6	**Regulation 6 Rule 5 compliance costs**						
	7	Annualized Capital Cost (CEMs for ammonia emission monitoring)	$279,000	$93,000	$93,000	$93,000	$0	$0
	8	**Regulation 8 Rule 18 compliance costs**						
	9	Annualized Capital Cost (data management systems)	$250,000	$110,000	$30,000	$40,000	$50,000	$20,000
	10	Annual Recurring Cost (additional component inspection)	$6,550,000	$2,490,000	$1,370,000	$860,000	$1,150,000	$680,000
	11							
	12							
	13							
	14							
	15							
	16							
	17							
Summary of Total Compliance Cost	18	Total Costs for 3 Rules In First 10 Years (annualized capital + annual recurring	$9,269,000	$3,212,000	$2,333,000	$1,238,000	$1,383,000	$1,102,000
	19	Total Costs for 3 Rules After 10 Years (annual recurring costs only)	$8,740,000	$3,009,000	$2,210,000	$1,105,000	$1,333,000	$1,082,000
	20							
	21							
	22							
	23							
	24							
	25							
Socioeconomic Impact Analysis	26	Total Impact on Estimated Net Profits, all 3 Rules, In First 10 Years	0.44%	0.49%	0.53%	0.30%	0.39%	0.53%
	27	Total Impact on Estimated Net Profits, all 3 Rules, After 10 Years	0.42%	0.46%	0.50%	0.27%	0.38%	0.52%
	28							
	29							
	30							
	31							
	32							
	33							

Source: Applied Development Economics, based on BAAQMD, California Energy Commission, EIA, and US IRS SOI

APPENDIX A: LIST OF EDD LMID BAY AREA "REFINERIES"

County	Name of Establishments	City	Number of Workers
Alameda	DASSEL'S PETROLEUM INC	FREMONT	1-4 employees
Alameda	RCA OIL RECOVERY	NEWARK	1-4 employees
Contra Costa	BAY AREA DIABLO PETROLEUM CO	CONCORD	1-4 employees
Contra Costa	CHEVRON CORP	RICHMOND	1-4 employees
Contra Costa	CHEVRON CORP	PACHECO	20-49 employees
Contra Costa	CHEVRON CORPORATION	SAN RAMON	5,000-9,999 employees
Contra Costa	PHILLIPS 66 RODEO REFINERY	RODEO	500-999 employees
Contra Costa	GENERAL PETROLEUM	RICHMOND	10-19 employees
Contra Costa	GOLDEN GATE PETROLEUM	RICHMOND	1-4 employees
Contra Costa	GOLDEN GATE PETROLEUM	RICHMOND	1-4 employees
Contra Costa	GOLDEN GATE PETROLEUM	CONCORD	1-4 employees
Contra Costa	NU STAR	MARTINEZ	20-49 employees
Contra Costa	PITCOCK PETROLEUM INC	PLEASANT HILL	10-19 employees
Contra Costa	SHELL MARTINEZ REFINERY	MARTINEZ	500-999 employees
Contra Costa	TESORO GOLDEN EAGLE REFINERY	PACHECO	500-999 employees
Contra Costa	UOP	DANVILLE	1-4 employees
Marin	GRAND PETROLEUM	SAN RAFAEL	1-4 employees
Marin	GREENLINE INDUSTRIES LLC	LARKSPUR	20-49 employees
San Francisco	DOUBLE AA CORP	SAN FRANCISCO	1-4 employees
San Francisco	R B PETROLEUM SVC	SAN FRANCISCO	5-9 employees
San Francisco	SEAYU ENTERPRISES INC	SAN FRANCISCO	5-9 employees
San Mateo	DOUBLE AA CORP	SOUTH SAN FRANCISCO	5-9 employees
San Mateo	SABEK INC	SOUTH SAN FRANCISCO	5-9 employees
San Mateo	SEAPORT REFINING & ENVRNMNTL	REDWOOD CITY	5-9 employees
Santa Clara	COAST OIL CO LLC	SAN JOSE	20-49 employees
Santa Clara	SHELL OIL PRODUCTS US	SAN JOSE	1-4 employees
Solano	BAY AREA DIABLO PETROLEUM CO	BENICIA	1-4 employees
Solano	CAT TECH INC	DIXON	1-4 employees
Solano	DANVILLE PETROLEUM	VALLEJO	5-9 employees
Solano	GOLDEN GATE PETROLEUM	BENICIA	1-4 employees
Solano	RUBICON OIL	BENICIA	1-4 employees
Solano	TIMEC CO INC	VALLEJO	20-49 employees
Solano	VALERO BENICIA REFINERY	BENICIA	250-499 employees
Solano	VALERO REFINING CO	BENICIA	1-4 employees
Solano	VALERO REFINING CO	BENICIA	1-4 employees
Sonoma	BAY AREA DIABLO PETROLEUM CO	CLOVERDALE	1-4 employees
Sonoma	ROYAL PETROLEUM CO INC	PETALUMA	5-9 employees

Source: ADE, Inc., based on California EDD LMID "Employers By Industry" Database